Orthogonal Mag. Field gradient

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☐ 1. Document ID: US 5898306 A Relevance Rank: 44

L4: Entry 1 of 1 File: USPT Apr 27, 1999

US-PAT-NO: 5898306
DOCUMENT-IDENTIFIER: US 5898306 A

TITLE: Single circuit ladder resonator quadrature surface RF coil

DATE-ISSUED: April 27, 1999

INVENTOR-INFORMATION:

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APPL-NO: 8/ 838604
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PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4707664	November 1987	Fehn et al.	324/322
4721913	January 1988	Hyde et al.	324/318
4752738	June 1988	Patrick et al.	324/318
4816765	March 1989	Boskamp	324/318
4839594	June 1989	Misic et al.	324/318
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4881032	November 1989	Bottomley et al.	324/309
4906933	March 1990	Keren	324/318
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OTHER PUBLICATIONS

Ballon, D., et al., "A 64 MHz Half-Birdcage Resonator for Clinical Imaging", J. of Magnetic Resonance, 90, 131-140, (1990).
Hu, X., et al., "Reduction of Field of View for Dynamic Imaging", Magnetic Resonance in Medicine, 31, No. 6, 691-694, (1994).
Mehdizadeh, M., "RF Coils for Magnetic Resonance Imaging", RF Design, 29-38, (1991).
Panych, L.P., et al., "A Dynamically Adaptive Imaging Algorithm for Wavelet-Encoded MRI", Magnetic Resonance in Medicine, 32, No. 6, 738-746, (1994).

ART-UNIT: 287
PRIMARY-EXAMINER: Arana; Louis
ATTY-AGENT-FIRM: Schwegman, Lundberg, Woessner, and Kluth, P.A.

ABSTRACT:

A single-circuit quadrature surface coil is formed from two ladder resonator coils and includes a first mode circuit path for detecting or generating magnetic flux in a vertical axis from a body under investigation and a second mode circuit path for detecting or generating magnetic flux in a parallel axis, with the first mode and second mode currents 90 degrees out of phase. The surface coil, which supports two resonance current modes for quadrature operation on only one single coil conductor structure, provides a high signal-to-noise ratio (SNR) and a good B.sub.1 homogeneity over the imaging volume. This coil alone may be used either for both transmitting and receiving RF signals or for detecting RF signals as "receive only." This coil is well suited for imaging the human neck, spine and heart.

17 Claims, 7 Drawing figures

Full | Title | Citation | Front | Review | Classification | Date | Reference   KWIC | Draw Desc | Image

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Term	Documents
ORTHOGONAL.USPT.	79010
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L4: Entry 1 of 1 File: USPT Apr 27, 1999

DOCUMENT-IDENTIFIER: US 5898306 A
TITLE: Single circuit ladder resonator quadrature surface RF coil

BSPR:
present invention pertains generally to Magnetic Resonance imaging (MRI) apparatus, and more particularly to a quadrature surface coil for use with MRI apparatus.

BSPR:
MRI provides a unique non-invasive imaging method for discriminating the main components of human disease pathology. As a result, MRI is one of the most widely used diagnostic imaging tools in today's hospitals throughout the world. A typical MRI system includes a main magnet to generate a uniform DC magnetic field, three gradient coils to generate linear and orthogonal magnetic field gradients, a transmitting and receiving radio frequency (RF) antenna to generate imaging pulses and receive the resulting RF emissions, and an operator interface and control station. For human imaging the magnet is mainly superconducting in nature and has a cylindrical shape, although at the present time open "C" arm magnet geometries are also used for imaging the human body. For higher strength magnetic fields (0.5 T and higher), the superconducting magnet is used to generate a highly uniform static magnetic field with a clear bore diameter of 90 cm or larger for human patient access.

BSPR:
In MRI, the resultant radio-frequency signals, which are spatially encoded, are picked-up by the receiver RF coil, amplified and then demodulated/digitized by a receiver. A sequence controller controls or schedules the timing sequence of the three orthogonal gradients, RF pulse waveforms, frequency offset, RF phase, data sampling window of the receiver, as well as other events such as triggering to generate a variety of MRI sequences, such as spin echo imaging, gradient echo imaging, fast spin echo imaging, and echo planar imaging. An image reconstruction processor sorts the spatially encoded image data according to the order in which they are received and transforms the data to form the final MR image.

DEPR:
The radio frequency transmitter 40 and the gradient control 44 under the control of the sequence control 46 elicit simultaneous magnetic resonance responses in planes or slabs through each of the quadrature surface coils 1 (or 1' or 1") and 38. The signals from the two quadrature surface coils are conveyed to a pair of quadrature combiners 50, 52. The quadrature combiners impose a 90.degree. phase shift on one of the detected quadrature components and combine the components. Preamplifiers 54, 56 amplify the signals before they are received by a receiver means 60, such as a pair of digital quadrature receivers 60.sub.1, 60.sub.2, which receive and demodulate the resonance signals. An interface circuit 62 includes analog-to-digital converters 64, 66 for digitizing each received resonance signal to generate a digital data line.

ORPL:
Ballon, D., et al., "A 64 MHz Half-Birdcage Resonator for Clinical Imaging", J. of Magnetic Resonance, 90, 131-140, (1990).

ORPL:
Hu, X., et al., "Reduction of Field of View for Dynamic Imaging", Magnetic Resonance in Medicine, 31, No. 6, 691-694, (1994).

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Mehdizadeh, M., "RF Coils for Magnetic Resonance Imaging", RF Design, 29-38, (1991).

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